

twenty-eight, inclusive, on the 1st, 2d, 3d, 9th, 15th, 24th, 26th, 27th, 28th, and 30th; in from nineteen to twenty-four, inclusive, on the 7th, 8th, 16th, 18th, 22d, and 25th; and in from thirteen to seventeen, inclusive, on the 4th, 5th, 6th, and 31st. There were no dates for which thunder-storms were reported in less than thirteen states and territories.

Thunder-storms were reported on the greatest number of dates, thirty-one, in Florida; on twenty-nine in Arizona; on twenty-eight in Dakota; on twenty-seven in Alabama; on twenty-five in Iowa, Kansas, Louisiana, New York, and Texas; on twenty-four in Mississippi, Nebraska, Ohio, and Tennessee; on twenty-three in Georgia and Minnesota; on twenty-two in

Illinois, Michigan, and South Carolina; on twenty-one in Indiana, and Missouri; on from fifteen to twenty, inclusive, in Arkansas, Colorado, Indian Territory, Kentucky, Maryland, Montana, New Jersey, North Carolina, Pennsylvania, Virginia, and Wisconsin; on from ten to fourteen, inclusive, in Massachusetts, New Mexico, Utah, Vermont, West Virginia, and Wyoming; on from five to nine, inclusive, in Connecticut, Maine, Nevada, New Hampshire, and Oregon, and on from one to four, inclusive, in California, Delaware, District of Columbia, Idaho, Rhode Island, and Washington Territory. There were no states or territories in which thunder-storms were not reported for one or more dates.

MISCELLANEOUS PHENOMENA.

FOREST FIRES.

Albina, Multnomah Co., Oregon, 17th: dangerous forest fires have been burning for the last week in this county and in the southern part of Washington Territory. The fires have caused losses which will aggregate \$750,000. Showers of sparks and cinders are flying over this place.—*Post-Express, Rochester, N. Y., July 17.*

Fort Assiniboine, Mont., 28th: forest fires are reported in the spurs of the Rocky Mountains west of this place.

Chico, Butte Co., Cal., 29th: forest fires are raging on the Humboldt Road, eighteen miles from this place. The fire has burned over a district four miles in length, and destroyed much valuable timber.—*Post-Express, Rochester, N. Y., July 29.*

Fort Benton, Mont., 29th: forest fires are raging in the mountains and along the banks of the Missouri for many miles below here. The Northern Pacific track east of Livingston, Park Co., was burned out for a short distance. Several mining camps have been deserted, and ranchers are plowing around their land to prevent the fire from spreading.—*Union and Advertiser, Rochester, N. Y., July 29.*

Glenwood Springs, Garfield Co., Colo., 30th: the forest fire which has been burning in this vicinity for several days past covers an area of over ten square miles. The air over the entire western slope is filled with smoke from the burning fires in the mountains.—*The Palladium, Oswego, N. Y., July 30.*

Sierra City, Cal., 30th: large forest fires are raging in this section.—*The Morning Call, San Francisco, Cal., July 31.*

Gunnison, Colo., 30th: for the last two or three days the mountains in this vicinity have been ablaze with burning timber. The fires are supposed to have started from sparks of locomotives.—*Oswego, N. Y., Daily Times, July 30.*

Susanville, Lassen Co., Cal., 31st: forest fires have been burning for the last two months to the north and west of this city, doing considerable damage to stock ranges and timber land.—*Report of T. B. Sanders.*

Boisé City, Idaho, 31st: extensive forest fires are reported in the mountains about forty-five miles north of this city. The fires have taken such proportions that the governor of the territory has requested aid from the Interior Department at Washington City in extinguishing them.

Helena, Mont., 31st: extensive forest fires have been raging in this section for the past ten days, destroying what little grass was spared by the long and protracted drought.

Forest fires were also reported as follows: Red Bluff, Cal., northeast and west of this city, 12th, 13th; San Diego, Cal., 29th, 30th; Linkville, Oregon, 26th, 28th; Roseburgh, Oregon, 27th, 31st; Port Angeles, Wash., 19th.

HALOS.

Solar halos were most frequently reported in Tennessee, where they were noted on thirteen days; in Illinois on eleven days; in Iowa, Kansas, Massachusetts, and New York on from five to nine days, and in Arkansas, Dakota, Georgia, Idaho, Indiana, Maryland, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, Ohio, Oregon, Pennsylvania, Rhode

Island, South Carolina, Texas, Virginia, Washington Territory, and Wisconsin on from one to five days. In states and territories other than those named no solar halos were reported. They were reported in the greatest number of states and territories, eight, on the 23d; in seven, on the 13th; in from one to six, inclusive, on the 1st, 5th, 6th, 8th to 12th, inclusive, 14th to 22d, inclusive, and from the 24th to 31st, inclusive.

Lunar halos were most frequently reported in Louisiana and South Carolina, where they were noted on seven dates; in Alabama, Illinois, Indiana, Iowa, Kansas, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, Nevada, New Jersey, New York, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, Wisconsin, and Wyoming on from one to five dates. In states and territories other than those named no lunar halos were reported. They were reported in the greatest number of states and territories, nine, on the 8th, and in from one to five, inclusive, on from the 1st to 7th, inclusive, 9th to 15th, inclusive, 18th, 22d, 23d, 27th to 31st, inclusive. For dates other than those named no lunar halos were reported.

METEORS.

The distribution of meteors by dates was as follows: 1st, Kalamazoo, Mich. 3d, Teviston, Ariz.; New Orleans, La. 5th, Louisville, Ill. 7th, Yellow Springs, Ohio. 9th, Chattanooga, Tenn. 10th, Charleston, S. C. 11th, Springfield, Ill.; Yellow Springs, Ohio. 12th, Springfield, Ill. 13th, Waverly, Ohio. 14th, New Orleans, La.; Dudley, Mass. 15th, Whipple Barracks (Prescott), Ariz.; Kissimee, Fla.; Charleston, Ill.; Dudley, Mass.; Beverly, N. J. 16th, Wheatland, Cal.; Crowley, La.; Sault de Ste Marie, Mich.; Lewer's Ranch, Nev.; Riddleton, Tenn. 17th, Tenafly, N. J.; Cedar Springs, S. C. 18th, Chicago, Ill.; Concordia, Kans.; Amherst, Mass.; Wedgewood, N. Y. 20th, Thornville, Mich.; Rolling Green, Minn.; Nashua, N. H.; Wilmington, N. C. 21st, Wedgewood, N. Y. 22d, Brownsville, Tex. 23d, Sault de Ste Marie, Mich.; Nashville, Tenn. 24th, Keeler, Cal. 25th, Villa City, Fla. 26th, Berkeley, Cal.; Kissimee, Fla.; Thornville, Mich. 27th, Whipple Barracks, Ariz.; Little Rock, Ark. 28th and 29th, Mesquite, Tex. 30th, Kissimee, Fla. 31st, Villa City, Fla.; Charleston, Ill.; Riddleton, Tenn.

Charleston, S. C.: a large meteor was observed in the north-western sky at 8.30 p. m., 10th. It was shooting down towards the horizon, with considerable rapidity, and burst when in about altitude 20°. Huge flakes of what appeared to be molten fire flew in different directions, and disappeared.—*The Daily Sun, Charleston, S. C., July 11.*

Springfield, Ill.: a very brilliant meteor was observed in the northern sky shortly after 11 p. m., 11th. As the meteor fell it resembled a large sky rocket descending to the earth, and while visible it changed colors several times.

Wheatland, Yuba Co., Cal.: a brilliant meteor was observed at 9.16 p. m., 16th. It consisted of a large pear-shaped ball of white light, followed closely by a smaller red one, falling slowly in a southeasterly direction at an angle of 45°. Immediately before disappearing the meteor burst like a rocket.—*Report of Mr. William Lumbard.*

Concordia, Kans., 18th: a bright meteor was observed passing from east to west at 10.15 p. m., leaving a streamer of pale white light 60° long in its wake.

Wilmington, N. C.: a brilliant meteor flashed across the sky from north to south at 11 p. m., 20th. The meteor left a silvery trail of light, like that of a sky-rocket, and when near the earth it burst into fragments and disappeared from view.

Nashville, Tenn.: a brilliant meteor was observed at 9.15 p. m., 23d, about 2° southeast of the zenith, and disappeared when about 10° above the southeastern horizon.

Whipple Barracks, Ariz.: a brilliant meteor was observed at 11 p. m., 27th, in azimuth 100° and altitude 75°; it travelled about 25° in a westerly direction and disappeared.

Little Rock, Ark.: a number of meteors were observed during the evening of the 27th, one of which was very bright, and was seen at 9.18 p. m., moving slowly from south to north, and having a bright orange-colored trail.

Charleston, Coles Co., Ill., 31st: a meteor was observed in the north, in altitude about 20°, at 8.40 p. m.; it shot across the sky in a southward direction, leaving a long white trail of light in its path. The meteor disappeared when about the same altitude in the south.—*Report of Mr. J. B. Dazey.*

MIRAGE.

Mirage were observed at Leech Farm, Dak., 30th, and at Traverse City, Mich., 31st.

SAND STORMS.

San Carlos, Ariz.: a severe sand storm occurred between 7.25 a. m. and 11.30 a. m., 3d. The sand and dust were so thick as to obstruct the view, objects six feet distant were not discernible, and the furniture in closed houses was covered by a layer of sand and dust one-eighth inch in depth. Sand storms have also been reported at Fort McDowell, Ariz., 11th, and at Wilcox, Ariz., 6th, 12th, 28th, 29th.

DROUGHT.

Winnemucca, Humboldt Co., Nev., 19th: reliable statements show that, in consequence of the prolonged drought, wheat sown last December yet remains in the ground plump and hard as when harrowed in. The ground was then dry, no rain having fallen for months, and it never has been moist enough since to sprout the grain. There are hundreds of acres sown to wheat and several acres sown to alfalfa, on the meadows, not one grain of which has sprouted, and the seed is apparently as sound as when it was sown. 30th: distressing accounts of loss of cattle from the scarcity of water along the Humboldt River continue to reach here. From Humboldt House, this county, west, the water holes in the Humboldt River bed are said to be lined with the decomposed carcasses of dead animals. The water in the sloughs and holes is impregnated with alkali, and when cattle, almost dying with thirst, reach there from the plains, they drink enough of poison-

ous water to kill them. A similar condition prevails on the Little Humboldt.—*The Silver State, Winnemucca, Nev., July 19th and 30th.*

Fresno, Cal., 31st: King's River, from where all the canals for irrigation in this section lead, is lower than it has been for seven years, and several of the large canals are closed. The water in this section is scarce.

Salt Lake City, Utah, 31st: the drought, which has prevailed during the entire month, continues. All vegetation in this section is withered, and the water is scarcely sufficient for household purposes.

Helena, Mont., 31st: the drought, which was already felt on the 30th of June last, has continued throughout this month, the amount of rainfall during the month being too small to be of any benefit. The crops in this section are completely ruined, some of them cannot even be cut for fodder, and the grass on the ranges has dried and blown away.

SUN SPOTS.

Mr. John W. James, Riley, McHenry Co., Ill.: none seen until the 12th, when the large spot reappeared; on meridian 18th, and disappeared by the solar rotation late on the 24th. From the 15th to the 21st two groups, very changeable, daily, of small spots were seen. 26th, small spots formed near the west edge; gone on the 28th. Still another new and changeable group formed near the east edge on the 30th and 31st, passing the sun's meridian August 2d. Mr. C. E. Buzzell, Leaf River, Ogle Co., Ill.: 13th, large spot appeared on the east limb by solar rotation, disappearing by solar rotation on the 24th. A new outbreak occurred just north of this spot while near the meridian on the 18th, subsiding on the 22d; this spot is a second period of the June 16th disturbance. 14th, small group newly formed near the meridian, disappearing on the 16th. 28th, a group of variable spots formed two days west of the meridian, disappearing in faculæ on the 30th. 29th, a variable group observed, two days in, on east limb, increasing on the 31st. Mr. M. A. Veeder, Lyons, Wayne Co., N. Y.: 1st, an extended group of faculæ was appearing by rotation, and continued active throughout its entire transit, being seen at the western limb on the 9th and 10th. This group returned also by rotation on the 26th, the small spots having formed meanwhile. On the 7th a group of faculæ appeared by rotation, and continued active throughout its entire transit, spots forming in connection with it when near the meridian on the 15th, and disappearing by rotation on the 20th. On the 10th, 11th, and 12th, an extended group of faculæ with a very large spot, seen also in June, came into view and persisted throughout the entire transit. On the 15th, faculæ appeared by rotation, and persisted, becoming the seat of a group of small spots when near the western limb on the 26th, disappearing by rotation on the 28th.

VERIFICATIONS.

FORECAST FOR 24 HOURS IN ADVANCE.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

The forecasts for districts east of the Rocky Mountains for July, 1889, were made by 1st Lieutenant Richard E. Thompson, 6th Infantry, Signal Officer and Assistant, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

Percentages of forecasts verified, July, 1889.

States.		States.	
Maine.....	75.9	Eastern New York.....	76.7
New Hampshire.....	72.8	Western New York.....	82.6
Vermont.....	73.0	Eastern Pennsylvania.....	76.5
Massachusetts.....	77.7	Western Pennsylvania.....	84.1
Rhode Island.....	79.9	New Jersey.....	75.3
Connecticut.....	77.0	Delaware.....	69.9

Percentages of forecasts verified, July, 1889—Continued.

States.		States.	
Maryland.....	68.1	Lower Michigan.....	74.0
District of Columbia.....	71.2	Upper Michigan.....	81.7
Virginia.....	71.5	Wisconsin.....	79.8
North Carolina.....	80.2	Minnesota.....	80.6
South Carolina.....	80.5	Iowa.....	78.9
Georgia.....	79.3	Kansas.....	83.4
Eastern Florida.....	84.1	Nebraska.....	80.2
Western Florida.....	78.6	Missouri.....	84.4
Alabama.....	78.4	Colorado.....	84.7
Mississippi.....	81.8	Dakota.....	85.2
Louisiana.....	84.0	Southern California*.....	93.7
Texas.....	89.2	Northern California*.....	90.0
Arkansas.....	80.1	Oregon*.....	87.7
Tennessee.....	82.1	Washington Territory*.....	87.8
Kentucky.....	83.5	By elements: Weather.....	83.8
Ohio.....	82.3	Temperature.....	72.8
West Virginia.....	85.0	Monthly percentage of weather and temperature combined†.....	79.4
Indiana.....	79.7		
Illinois.....	81.4		